Data Science for Finance

Computational Finance

GROUP ASSIGNMENT, 2023-24

1. **[15.0] Consider the following bond market information for a set of Treasury government bonds:**

Bond	Coupon rate	Coupon frequency	Maturity (years)	Dirty-Price (% of par value)
1	1,50%	Annual	1	96,60
2	1,75%	Annual	2	93,71
3	2,00%	Annual	3	91,56
4	2,25%	Annual	4	90,24
5	2,50%	Annual	5	89,74
6	2,75%	Annual	6	90,04
7	3,00%	Annual	7	91,09
8	3,25%	Annual	8	92,82
9	3,50%	Annual	9	95,19
10	3,75%	Annual	10	98,14

a) [1.0] Build a class called YieldCurve that will receive an array with information on maturity, price and coupon for n bonds (n x 3)

b) [2.0] Add a method that will bootstrap the discount factors using matrix operations

c) [2.0] Add a method that will bootstrap the discount factors using a global solver

d) [2.0] Add a method that will bootstrap the discount factors using an iterative procedure

e) [2.0] Determine the spot rate (annual compounding) for each maturity from the calculated discount factors and plot them

f) [2.0] Determine the YTM for each bond and plot them

g) [2.0] Determine the 1y forward rate starting in each of the years from 1 to 9 and plot them

h) [2.0] Make a plot of the spot rates, yields and forward rates with a legend identifying the series

2. [5.0] DataFrames: write python code for the following tasks

a) [1.0] Get historical data (close price and volume) for 5 stocks of your choice using any API of your choice from 2012 to the present time

b) [1.0] Plot the cumulative returns of the stocks on a single chart

c) [1.0] Create the correlation matrix of the daily returns

d) [1.0] Save the data (close price and volume) to a CSV file for each ticker

e) [1.0] Load the data from the CSV files you saved into a single DataFrame with the prices for each ticker

GROUP SIZE

Standard (and recommended) group size will be 5. You will organize your own groups.

PROJECT MILESTONES/REPORTS

The commented code (jupyter notebook or python script) should be submitted no later than November 2nd, 2023 via Moodle or by email to dduarte@novaims.unl.pt.